Review Comments related to the portions of the California Department of Water Resources (DWR) ***Draft Programmatic Environmental Impact Report (PEIR) for the Salton Sea Ecosystem Restoration Program*** dealing with air quality assessment. As requested by DWR I focused my review on chapter 10 and appendix E which deal with air quality and particularly PM10/dust emission potential from 'to be exposed' areas within the lake. I made comments as I read the report and since some topics are discussed in more than one section there are comments on that topic at different locations in the review.

Pat Chavez
Research Physical Scientist
United States Geological Survey (USGS)
Flagstaff, Arizona --- 928-556-7221
pchavez@usgs.gov
January 16, 2007

General Comments:

The work presented in the PEIR report is a massive and very challenging under taking and I am impressed by the extent and detail of the resulting product. Making predictions of what will happen is always a challenge, however, in this case I believe it is particularly difficult because of the limited amount of data and information that are available. The part of the report that I reviewed (dealing with air quality) is well written and includes a lot of detail in the form of tables and written text. I do have some questions and concerns about some of the assumptions and model results being generated that are addressed in the specific comments section below.

Because of limited time on my part and the deadline to submit the comments I covered mostly the information presented in chapter 10. I read appendix E which expands on what was presented in chapter 10 but did not have the time to finish writing up my comments, however, they followed along the lines of what I said about chapter 10.

Specific Comments:

Data Sources and Limitations (p. 10-7) and Met Monitoring Stations (p. 10-10)

- Table 10-2. CIMIS stations 141, 154, and 180 which are close to the lake are missing in table 10-2; 141 and 154 are located on the north/NE side of the lake and 180 on the southwest side. What does '*ave*' in table 10-2 mean? Is it the annual average of all the hourly averages or something else? Does '*max*' mean the maximum hourly average or the maximum wind encountered (max hourly wind speeds are typically greater than the hourly average --- by a factor of 1.5 to 4 at one of our sites in the Mojave Desert)?

  Note that the data used in table 10-2 were collected during 2005 which was a relatively wet year that resulted in a dramatic increase in the amount of annual vegetation and grass cover in the desert that winter and spring. Therefore, from a dust/PM10 point of view this data set might not be 'representative' because the amount of sheltering given by the increased vegetation cover may have

influenced/reduced the amount of dust emitted from the desert landscape during that time period.

- In one of our projects we have looked at the wind characteristics around the Salton Sea using data collected by both CIMIS (2m) and CARB (10m) stations. We had similar questions and concerns about the 2m vs 10m height of the wind sensors. We looked at two years worth of data at six CIMIS and three CARB sites and compared the wind data for the CIMIS and CARB sites located near Niland. These two Niland sites, which are very close to each other, are in a natural/rural setting close to the lake (i.e., there are few, if any, buildings, large trees, or topographic features that could cause potential wind shadows and sheltering of the sensor from the winds). From the analyses of the wind data collected by the CIMIS and CARB stations at Niland, plus the fact that a typical vertical wind velocity profile as a function of height is exponential, the indications are that the CIMIS data can probably be used as a 'lower bound' of the winds speeds that would be recorded by a CARB type 10m station (i.e., wind speeds recorded by a CARB 10m station at that location would be 'at least' this high). When viewed in this manner the CIMIS data collected by stations on the northern half of the lake indicate that the winds recorded at the Indio-Jackson station are much lower/calmer than winds near the north half of the lake (more on this later in the review).
- A general question that must be kept in mind is 'how appropriate is it to use the HOURLY AVERAGE wind speed to determine if the threshold wind velocities have been reached during stable and unstable conditions/time periods'. This is a question relevant to dust emission in general and not just the Salton Sea. Data collected in the field by met stations that include sensit sensors that detect sand/soil saltation (when sand and/or fines are moving close to the surface), as well as the wind tunnel/PI-SWERL data collected by the Desert Research Institute (DRI) at sites around the Salton Sea to measure sand/soil movement, indicate that the thresholds of 15mph for unstable and 25mph for stable conditions are in the ball park. However, the field data typically represent wind velocities measured over a much shorter time period than an hour (i.e., in the order of a few minutes). At one of our sites in the Mojave Desert where we are collecting wind data I recently looked at the relationship between the 'HOURLY MAXIMUM' vs the 'HOURLY AVERAGE' wind speeds collected over a three month time frame (Sept 11 to Dec 11, 2006). The hourly average wind speeds ranged from calm to about 28 mph and the hourly maximum from calm to almost 50 mph. The linear relationship between these two wind data sets had an R square value of 0.92, with the correlation indicating that for hourly average wind speeds of 15 and 25 mph (the two thresholds being used in the dust emission modeling) the approximate 'hourly maximum' values were 25 and 39 mph, respectively ---- significantly higher. The National Weather Service within NOAA define sustained winds related to cyclones as a 1 minute average which they call 'relatively long-lasting' and as a 2 minute average when talking in general about sustained winds (both measured at a 10m height). These definitions would classify a higher number of wind events as exceeding the threshold wind velocities of 15 and 25 mph than the

hourly average used for this work (i.e., more potential dust producing wind events).

The question for the general dust community, not just for issues related to the Salton Sea, is how to define 'sustained' winds for use in dust emission related studies and modeling. This is an area where project level studies will be needed at the Salton Sea, however, in the mean time perhaps some research related to this has been done at Owens Lake that could provide some guidance. It also identifies a data gap that needs to be addressed for future project level studies (i.e., high temporal resolution wind data around the lake).

Background Conditions ---- Winds

- Questions and comments related to figures 10-2 and 10-3. From a comparison point of view figure 10-2 represents four years and 10-3 three years, plus the scales seem to not be the same. You may want to indicate in the figures that the wind speeds are hourly averages and consider adding a column to the wind speed scale bar that shows the number of hours/readings at each of the wind intervals (i.e., how often did wind speeds in the given range occur). This information could be used to estimate how many days per year you might expect to see winds in the range that might produce dust emissions. For example, in figure 10-3 for Niland there is 25,338 hours covered over the three year time period which means that winds that occurred 5% of the time translate to occurring 1267 hours. If you assume that in general these winds occur for about five hours per day when they do occur, this translates to 253 days over the three year period covered by the chart. This means that winds in this range would occur for about five hours on 84 days per year. This type of analysis could be used to help predict how often winds above the threshold velocities might occur during the period when playa surfaces are considered unstable.
- ***Stable vs Unstable Time Periods (page 10-27 and 28)***
  I think the amount of time allotted to stable and unstable conditions for playa surfaces might be in the ball park (i.e., four months as unstable and eight months as stable conditions). However, I don't know if within the general dust community there is enough knowledge about all the parameters that influence stable vs unstable conditions to be able to pin down the length of time that this conditions last and when they occur. The length of time and when stable vs unstable periods occur can vary as a function of climate and hydrological conditions at a given site during a given year (i.e, the length of time could be four months one year and six another year, plus the unstable period could slide in time one direction or the other). At a minimum, based on what we have seen in the Mojave Desert, I would consider adding two to four weeks to the length of the unstable period and, perhaps more important, consider moving the period of unstable conditions forward one month (i.e., make the unstable period from the first of January to the end of April). Even though this would not expand the length of the unstable time period and moves forward the time period by only one month it could have a significant impact because it is generally more windy in April than in December. If the playa areas do begin to become unstable in

December I would suggest making the unstable period go from mid December to the end of April. During the latter part of November and thru mid December of 2006 (last month) there were several moderate to high winds in the southwest, including the Salton Sea area and two playas we are monitoring in the Mojave Desert (Soda Lake by Baker, CA and Franklin Lake due east of Death Valley); winds during November 27th to 29th and December 15th to 17th caused dust emissions from barren desert areas, however, little to no dust was seen being emitted from playa surfaces. However, dust has been observed being emitted from these two playa surfaces during November of other years.

In general, the discussion of unstable and stable time periods and length of time in the report is directly related to playa surfaces. If any of the 'to be exposed' areas are more like barren desert rather than playa surfaces a different definition of unstable and stable conditions would have to be examined which could affect the modeling results.

Wind Characterization and Data Site Selection

- I question that the Indio-Jackson CARB site data set is representative of what the wind characteristics are for the northern half of the Salton Sea. To begin with, the Indio-Jackson station is well removed from the northern end of the lake, plus the station is located in more of an urban setting rather than an open rural/natural one that is typical around the lake (e.g., at the Niland site). There can be significant differences in the amount of 'wind sheltering' that occurs by buildings and trees at the Indio-Jackson site compared to areas around the lake (not to mention that this site is probably also sheltered more from the winds by the mountains to the west than are areas close to the lake). In our study that included analyzing data from nine stations in the Salton Sea region, the Indio-Jackson site was the least windy site. There are CIMIS sites located closer to the northern side of the lake and data collected by these stations indicate that this area is more windy than the Indio-Jackson station predicts. I understand the concern about the differences between wind data collected by CARB and CIMIS stations at 10m and 2m heights, respectively, but keep in mind that generally the wind height profile is such that the wind speed increases exponentially as a function of height. Therefore, data collected by CIMIS stations could be viewed as representing a 'lower bound' on the winds at the given site (i.e., a CARB type station would record wind speeds that are at least this high; probably higher). With this in mind, the CIMIS data from several sites on the northern half of the lake indicate that the Indio-Jackson data are not representative of the wind characteristics at the northern half of the lake. If the report's assumption that the Indio-Jackson wind data are representative of the northern half of the lake is accepted, which indicates that due to the relatively calm conditions no dust emissions will occur from the northern half of the lake at any time, then from an air quality point of view it seems that an alternative that keeps the southern half of the lake covered with water and exposes the northern half of the lake would be optimal. At this stage I think this assumption needs to be evaluated further before assuming that the entire northern half of the lake will not emit any dust at any time.

Background Conditions --- PM10

- Table 10-4 on page 10-18. As with the wind data, the Indio-Jackson station might be to far away from the lake to be representative of the background conditions at the northern half of the lake. However, unlike the wind data there are no stations close to the northern half of the lake that collect PM10 data. This is a data gap that needs to be addressed for future project level studies.
- The method used to collect most of the available historical PM10 data is a 24 hour sample taken every six days, so this type of data collection may or may not capture a sample during times when dust is in the air due to high winds. Some CARB stations have been modified recently (last couple of years) to take PM10 measurements every two hours, however, these data are limited both spatially and historically around the lake.

  Were the values shown in table 10-4 derived from all the data collected during this time period or were samples collected during windy days removed to avoid using potential high dust event days as representative of background conditions? For example, the high 24 hour average shown for 2001 and 2003 are much higher than those for the other years, so I would suspect that perhaps they were collected during high wind events and may not be representative of background conditions?
- Table 10-8 on page 10-23. A couple of things stand out in this important table: first is the fact that fugitive windblown dust accounts for approximately 69 percent of the total PM10 emissions in the region. Second, 96 percent of this comes from Imperial County and only 4 percent from Riverside County. I would think that the areas 'to be exposed' within the current lake will be more like those in Imperial County (i.e., rural and open/natural setting --- in contrast to the more urban setting of the Indio-Jackson area). Also, the footnotes in table 10-8 indicate that Imperial County estimates were higher, but state 'would not otherwise be expected to vary greatly between years'. The data shown in this table were collected during 2005 when it was relatively wet in the desert and there was a dramatic increase/bloom in annual vegetation and grass cover, which means there was a possibility that the amount of windblown fugitive dust was affected (decreased) because of the additional sheltering of the soils during this time period.

  According to the table, fugitive windblown dust is by far the largest single emission source (accounting for about 69% of all emissions). One thing to keep in mind is that these values represent a tons/day average, but since a large portion of the windblown dust will occur in the relatively few days when the threshold wind velocities are exceeded, especially during unstable conditions, the values will be much higher during those days.

Method for estimation of PM10 emissions from exposed playa areas

- In page 10-27 it is stated that the empirical MacDougall method used to model and predict dust emissions 'relies heavily on emission factors developed through use of wind tunnel and/or PI-SWERL study results'. As was pointed out at the beginning of chapter 10 and appendix E there are limitations and uncertainties in

being able to predict even relative amounts of dust emissions under the different alternatives being considered. A large uncertainty at this time is how well do the wind tunnel/PI-SWERL study sites used to generate the data for the dust emission model represent 'to be exposed' playa areas. Out of the 17 sites used for the field study about 8 of them were labeled as 'playa like', with several of these sites not tested during the three field surveys because they were either selected after the first field survey (Sept05) or were to wet for testing during the third survey (March06). Were the wind tunnel/PI-SWERL results from all the study sites used in the dust emission modeling efforts? Were any modeling runs made using only the results from sites classified as 'playa like'? If not, it might be worth doing since these sites might be more representative of 'to be exposed' areas than the other sites (see the next paragraph).

When soil texture (particle size) characteristics of the wind tunnel/PI-SWERL field study sites are compared with the soil characteristics of the 800 grab samples collected and analyzed by Agrarian Research in 2003 it appears that approximately 50% of the wind tunnel/PI-SWERL sites have characteristics similar to the Agrarian samples collected at the 'shore line' (as you might expect ---- see Figure 4-5 in the DRI wind tunnel/PI-SWERL report) and different from the large majority of the underwater grab samples. The soil texture characteristics of most of the remaining 50% of the wind tunnel/PI-SWERL study sites also seem to fall outside the general characteristics of the non-shore line Agrarian grab sample results. It appears that the soil texture characteristics of samples collected in water depths of 5, 10, and 15 feet (away from the shore line) are different from most of those at the wind tunnel/PI-SWERL field sites. This needs to be kept in mind when analyzing the modeling results showing the amounts of dust emissions that will occur in 'to be exposed' areas.

- In page 10-29. At the top of this page the assumptions that were applied to calculate the emissions for each alternative and each phase are given. As already mentioned, I am not sure about the Indio-Jackson wind data station being representative of the northern half of the lake; I would suggest that you consider moving the unstable four month period forward one month and perhaps add a couple of weeks; I think the 15 and 25 mph threshold wind velocities are in the right neighborhood, however, I am not sure if this should represent a 2, 5, 10, or 60 minute average and perhaps some work has been done at Owens Lake that can help with this question.
- In page 10-29. The 30, 50, and 20 percent range given in the middle of the page (as well as in table 10-14 on page 10-36) relates to the assumption that 30 percent of the exposed playa area would be non-emissive and 70 percent could be emissive. This might or might not be the case, but assuming that it is, keep in mind that it applies to the entire area that will be exposed and the split may not be the same within different portions of the lake. Given the distribution of sand, silt, and clay, as well as barnacles, shells, and fish bones the percent of exposed area that will be vulnerable to wind erosion could be quite different in various parts of the lake. The 30 and 70 percent split might be about right for the entire area to be exposed, as well as some sub area, however, there could be areas of the lake

where this split could be very different, which could impact the results for each alternative based on what areas are exposed by that particular plan.

As you know, part of our work has included looking at results from an acoustics survey in an attempt to extract surface sediment characteristics and relate that to potential wind erosion vulnerability levels. I think this is an important issue and that more project level work will be needed.

- Page 10-32 and tables 10-10, 10-11, and 10-12. When looking at 'general conformity' process, including comparison of net emission increases, keep in mind that the 'annual' tons/yr will come mostly during the unstable four month period when threshold wind velocities are exceeded. The potential impact during those relatively few days will be quite different/larger than when the total dust emissions are spread over an entire year.

  As stated in the report, there are uncertainties and limitation because of the data and information available at this stage, so the output of the dust emission modeling is being used for 'relative' comparisons between the various alternatives. I think this is a good use of the model output. However, it seems that here and elsewhere in the report (including appendix E) the numbers being generated by the model for the various alternatives are at times being used in a some what absolute rather than relative sense. I had expected to see more comparison similar to those used in table 10-15, which gives in the comment section statements like 15, 25, and 150 times more dust rather than a specific amount of dust. Predicting that one alternative will potentially emit 25 times more dust than another alternative keeps the comparison relative, but once a number is given for each alternative it implies a more absolute comparison; especially when those numbers are then taken and compared with current background conditions, as well as state and national standards.

Summary of Impact Assessment

- Page 10-38. This section summarizes the assessments of the alternatives as compared to existing conditions. At this stage, it is not clear how well the current background conditions are know, so more project level work will be needed to document local and regional background status within the Salton Sea air basin.

  The report states that the 'no action alternative is inherently challenging'; I would say this is true for all the alternatives.

  The report states that pollutant transport from Mexico also influence air quality compliance in the region. However, from a potential Salton Sea dust emissions point of view it is not clear at this stage if more dust might be transported south into Mexico than what will be transported north from Mexico during high wind events when exposed playa surfaces will be unstable.
- Table 10-15 on page 10-39 to 10-49. This table shows the impact assessment of the various alternatives due to construction. It shows criterion for dust/PM10 emissions exceeding local significance thresholds of 150 pounds/day or 70

tons/year. This seems to be another example of taking a relative comparison between alternatives and then comparing them in an absolute sense.

- Pages 10-55 and 56. Figures 10-5 and 10-6 is perhaps another example of taking the output model results generated for a 'relative' comparison between the various alternatives and using them in a somewhat 'absolute' sense. The graphs show the amounts of PM10 emissions for each alternative (in an absolute sense), plus puts the 'threshold 70 ton/yr' line showing how much each one exceeds this level.

Appendix E

Since appendix E supports/expands on what was presented in chapter 10 many of the comments made above are applicable to sections/tables in the appendix. Also, some of the comments made below will be similar/reinforce what was said above.

- Bottom of page E1-1 has the following statement: 'The assumptions and limitations listed in the PEIR in Chapter 10 apply to the results presented in these tables. Please note that these emissions estimates are estimates, and they include many sources of uncertainty. Results should be used only for comparison and evaluation of the alternatives'. This is an excellent statement and needs to be kept in mind as you look at the results shown in tables within both chapter 10 and appendix E. As stated above at several places, it seems that at times comparisons are being made more in an absolute sense rather than a strictly relative one.
- In table E1-2, as in other tables, the emissions are given in the form of 'annual' and 'daily average' values. Isn't this spreading the impact over a longer period of time than when the actual majority of the impact will occur (i.e., during windy days within the unstable period). Has an attempt been made to evaluate the impact over a shorter period of time, say during the four unstable months and/or during a percentage of days within these four months when high winds will occur?
- Tables E2-1 thru E2-7. Here is another place where relative values could be used in place of (or along with) the absolute type values currently presented in the tables. For example, take the maximum value for each component and divide all the entries by that values --- this would make the maximum entry 1.0 and the rest a fraction of this --- or divide each entry into the maximum value which would give the number of time greater the maximum is than that particular entry.
- A footnote in table E2-2 states that 'dust emission on unpaved industrial roads is based on 8.5 percent silt content….'. I assume the soils for the roads will be trucked in from outside the lake area? From the particle size analysis done by Agrarian on the 800 grab samples it appears that once you get to the five feet water depth that to be exposed areas contain silt contents that are well above 8.5%.

Due to the dead line to submit the comments I have to stop at this stage, but would be willing to follow up with more comments and/or discussions either on the phone or in person after you have had time to look over these comments.